



Exploration & Production

GENERAL SPECIFICATION

ELECTRICAL

GS ELE 364

Electrical installations

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1. Scope

This specification describes the minimum technical requirements for construction and installation of COMPANY's electrical facilities located either onshore or offshore.

It does not cover earthing and bonding requirements, which are defined in the Specification **GS ELE 031**.

Temporary Construction Camps and associated facilities (onshore) are covered by the specification **GS CIV 403**.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

The installation of equipment and materials shall conform as a minimum requirement to the current edition of the following in order of precedence:

- Applicable laws, rules and regulations of the country in which the system will be operated
- In cases where no "local" regulations exist, then French laws and legislation shall be used
- COMPANY Project Specifications (if any)
- COMPANY General Specifications
- Applicable International Electrotechnical Commission (IEC) publications
- Applicable CENELEC Standards
- Applicable recognised standards and codes (e.g. UTE, BSI, VDE, etc.) where IEC publications have not yet been issued.

Standards

Electrical installation shall conform in design, material and performance with the appropriate sections of the latest editions (with amendments) of the following standards:

Reference	Title
IEC 60 079	Electrical Apparatus for explosive gas atmospheres
IEC 61 892	Mobile and fixed offshore units - Electrical installations
IEC 60 364	Electrical installations of buildings
IEC 60 529	Degrees of protection provided by enclosures

Professional Documents

Reference	Title
Not applicable	



Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS CIV 403	Temporary Construction Camps and associated facilities
GS COR 350	External protection of offshore and related structures and equipment by painting
GS ELE 031	Design of earthing and bonding systems
GS ELE 079	Electrical apparatus for explosive gas atmospheres
GS ELE 081	Lighting
GS ELE 161	Electrical cables
GS ELE 311	Cable trays/Ladders
GS INS 107	Design and installation of instrumentation links

The CONTRACTOR shall advise the COMPANY of any deviations made in respect of this Specification at the time of tendering. Should this Specification conflict with requirements of the listed standards the CONTRACTOR shall request clarification from the COMPANY.

3. Installation of electrical equipment

3.1 General requirements

All items of electrical equipment such as generators, transformers, switchgear, MCC, batteries, chargers, motors, etc., shall be installed in the locations as defined on the drawings. Methods of installation shall be in accordance with MANUFACTURER's instructions and, where appropriate, under the supervision of the MANUFACTURER's representative.

Major engineered items of equipment will be supplied free issue to the CONTRACTOR. However the CONTRACTOR shall be responsible for furnishing all materials (mainly bulk

materials) and equipment necessary to complete the electrical installation in accordance with the specifications and drawings.

The omission from this specification of any item or items essential for the correct functioning of any part of the specified equipment shall be brought to the attention of the COMPANY. Failure to do this shall not absolve the CONTRACTOR from installing the equipment complete in every respect.

The CONTRACTOR shall ensure that all MANUFACTURER's recommendations for the preservation and maintenance of all equipment (e.g. megger tests of rotating equipment, regular rotation of large motor/generator shafts as necessary) are implemented immediately after the equipment is received by the CONTRACTOR. Throughout the construction period, The CONTRACTOR shall ensure that all equipment and materials are adequately protected.

Steelwork, painting and internal insulation of the electrical room and battery rooms, etc. shall be completed to the COMPANY satisfaction before any electrical equipment installation.

Upon COMPANY requirements, the CONTRACTOR shall provide temporary HVAC/ heating facilities in technical rooms during the construction phase.

Anti-condensation heaters in switchgear, packages and motors shall be energised as soon as possible after installation, if necessary by means of temporary power supplies.

3.2 Floor standing equipment

It shall be the CONTRACTOR's responsibility to ensure that prepared floor foundations are in accordance with the MANUFACTURER's requirements before the equipment is positioned. In case of premises with raised floor, equipment shall be installed on metal frame fixed directly to the ground and appropriate to their dimensions and weight. Equipment shall be fixed on metal frame by bolts.

Following installation, the CONTRACTOR shall ensure that equipment is secured and levelled. Where equipment is supplied in separate parts (e.g. HV and LV switchgear), their alignment, assembly and electrical connections shall be executed by the CONTRACTOR in accordance with the MANUFACTURER's instructions. The CONTRACTOR shall verify that mechanical function, as plug-in, removable part facilities are still correct.

The bus bar jointing for HV and LV switchgear shall be carried out under the responsibility of the switchgear MANUFACTURER.

3.3 Wall mounted equipment

Wall mounted equipment shall be fixed either by support embedding or by using studs or expansion bolts.

Operating, control and measuring apparatus shall be at a height between 1.5 m and 1.8 m above finished ground level.

3.4 Suspended ceiling

The direct fixing of luminaries to the suspended ceiling is prohibited.

Installation of control, isolating equipment, circuit breakers and timers is prohibited. Only junction box installation is allowed.



3.5 Raised floor

No electrical equipment installation under raised floor is allowed, except junction boxes.

Cables of different types shall be laid in dedicated cable trays.

3.6 Lighting and small power

The CONTRACTOR shall fabricate any supports necessary for such items as local control stations, junction boxes, lighting fixtures, plugs and sockets, panels, etc. as per the typical installation drawings. They are to be fabricated from painted steel channel or angle as necessary to the satisfaction of the COMPANY. Supports shall be drilled before blasting and painting.

All junction boxes shall be accessible from grade or walkway level, with the exception of lighting junction boxes.

3.6.1 Lighting

Illumination levels shall be maintained at the values indicated in the specification **GS ELE 081** or in the project specification.

Lighting fittings shall be installed in accordance with the standard lighting details drawings and VENDOR's detailed instructions.

Where practical, lighting fittings and associated junction boxes shall be mounted in straight lines suspended from lighting/cable support channel. All lighting fixtures shall be mounted at 2.5 m minimum above grade, unless otherwise stated on the drawings.

The lighting fittings locations are shown on the drawings for guidance only. Final locations shall be the responsibility of the CONTRACTOR and shall avoid conflicts with piping, steelwork or other items, which would cause deep shadow areas. Locations shall be such as lighting fittings are accessible from walkways or temporary ladders for cleaning, maintenance.

The number of lighting fittings on a circuit and supply origin of the circuit shall be in accordance with distribution board one line diagrams. Any alteration to circuits shall be approved by COMPANY and marked up on the relevant one line diagrams.

Cables for lighting sub-circuits shall be field routed. They shall be supported by means of channel or cable rack/tray as deemed suitable for the location. Use can also be made of power cable/racks where approved by COMPANY.

Cabling for normal and emergency lighting shall be installed on different routes. A tray/rack divider may be used in the final routing for a long run of fittings.

Cable trunking will be used for lighting cables whenever possible.

If shown on the one-line diagrams, level gauges will be connected into the lighting circuits.

3.6.2 Plugs and Sockets

If the same circuit feeds multiple socket outlets, each socket shall be connected via a junction box.

3.6.3 Control stations

When required control stations and safety switches for motors and equipment shall be located, whenever possible, close to the motor or equipment, at the non drive end side and opposite to the terminal box.



Electrical control components shall be located so as to be accessible from aisles and areaways used in normal operation. They shall be mounted with their centre line at minimum 1.50 m above the deck or floor.

3.6.4 Heat tracing

Each heating tape shall be terminated in a junction box using a suitable cable gland supplied specifically for that purpose. Each junction box shall be mounted immediately adjacent to the end of the heating tape attached to a dedicated support.

The end of the heating tape opposite to the junction box shall be sealed using the proprietary seal.

All tapes and associated items shall be installed strictly in accordance with the MANUFACTURER's instructions.

3.7 Hazardous Areas

All electrical equipment shall be suitable for operation in the area in which it is to be installed, in accordance with the requirements of the CENELEC/IEC Standards, and shall have type examination certificates accordingly.

The CONTRACTOR shall pay special attention to the correct installation and connection of equipment and cabling to ensure it is in strict accordance with all the requirements related to the classified hazardous area (refer to the certificates).

No drilling, welding, etc., is allowed on EEx"d" equipment.

CONTRACTOR shall be responsible for laying out and drilling the gland plates of all non-certified electrical equipment. For EEx"e" box, only untapped holes shall be used if necessary. Other drillings are prohibited.

4. Cables and accessories

4.1 General

All cables shall be in accordance with the COMPANY Specification **GS ELE 161** and project specification if any.

All cables shall be of one continuous length from outlet to outlet. No cable splice shall be permitted. Exceptionally when necessary length cannot be arranged on a single drum for manufacturing reasons, resin cast splicing box, SCOTCH or equivalent shall be used. All splicing boxes, if any shall be reported on field by specific marker and on the drawings.

Cables will have a contingency allowance at each length. CONTRACTOR, however, shall verify that length allowed in the cable schedule are sufficient by field measuring the cable route prior the cutting.

4.2 Routing

4.2.1 General

Cables routings shall be as per design documents. Where no design routings exists, e.g. for lighting and small power socket outlet cables it shall be CONTRACTOR's responsibility to field routes these cables. These routing shall be subject to COMPANY approval prior to installation.

Separate routings shall be used for:

- H.V., L.V. power cables, measuring, signalling, solenoid and/or relay output cables, telecom cables and hydraulic tubing
- Standby and duty equipment
- Emergency/Essential and normal equipment.

Individual LV motor's power, control and anticondensation heater cables shall be grouped together with cable ties.

Cable for intrinsic safety circuits shall be laid in accordance with the specification **GS INS 107**.

Cable runs shall be routed and run in vertical and horizontal planes, as far as possible and shall be run with the minimum number of changes of direction consistent with good engineering practice and neat appearance.

Cable runs shall be routed in such a manner that routine maintenance and removal of equipment can be carried out without disturbing the cable run.

Cables shall not be fixed direct on structural steelwork. Telex or conduit shall be always used.

4.2.2 Segregation

Segregation distances between various systems and voltages shall be as follows:

Minimum distances (for parallel routings) between power and electronic/Signal wiring:

- LV 600 mm
- HV up to 33 kV 1000 mm

For cable crossings (at right angle), minimum distances shall be 200 mm.

Separate racking/trays shall be used and generally arranged top to bottom in the following manner:

- H.V. cabling
- L.V. power and lighting, DC control supplies, electrical multicore control cables (Non IS type)
- Electronic and signal cables (e.g. ECS serial links cables)
- For instruments cables see the specification **GS INS 107**.

4.2.3 Buried in ground

Cable shall be direct buried except in paved areas or railways where they shall run in concrete trenches.

Horizontal block and cable routing markers, which shall be installed every 50 meters, at changes of direction and where cables enter buildings, shall identified the location of cable trenches In paved areas.

Cables trenches shall be 1 m deep unless otherwise specified. The trench bottom shall be covered with sand bed to a depth of 0.15 m.

A layer of sieved and compacted sand 0.2 m deep shall separate each cable layer.

Top layer of cables shall be covered with 0.2 m minimum of sand before placing protective cable tiles, where appropriate and back filled to grade level.

The trenches shall not be refilled until all cable tests have been completed and COMPANY approval.

Cables shall be buried in three layers maximum, with warning devices to the diggers: one layer of red tiles 7.5 cm above the cables and one red plastic mesh 20 cm above the cables. The mesh shall cover the entire trench width and overlap the cables at the outer edges of the trench.

Top layer shall be laid at 800-mm minimum below grade level for HV cables and 600 mm minimum below grade for LV and control cables.

HV cables shall be completely separated from LV cables by horizontal and vertical range of concrete tiles.

In areas where spillage of pollution or corrosive substance may be expected, tube top entry shall be sealed with compound to prevent corrosion agent entry in the trench. This compound shall not harden under sunrays.

4.2.4 Cables ducting in ground

Ducting shall be PVC type or high-pressure polyethylene and shall have a minimum internal diameter of 150 mm.

When they cross roads, the ducts shall be embedded in concrete. The top generatrix of the ducting shall be at least 0.6 m below finished ground level.

Manholes 1.2 m x 1.2 m minimum of appropriate depth shall be provided:

- On each side of each road crossing
- At each change of direction
- Every 40 m on straight sections
- Back-filled with sand and with each entry plugged with suitable compound.

Ducts shall be filled to a maximum of 30% and a spare pulling wire shall be left in each conduit.

PVC protection pipe ends shall be smoothed or bent to avoid possible cable damage, steel pipes shall be fitted with bushings.

4.2.5 Concrete trenches

Prefabricated concrete trenches shall be laid on a bed of sand 10 cm thick and provided with a joint between units.

Depending on the project specification, concrete trenches may be:

- Fitted with cable supports or brackets at 0.5 m intervals (generally used with high concentrations of large cross-section cables) or cable trays or ladders
- Without any support, cables are laid in layers as in trenches.

The concrete trenches shall be covered with removable slabs appropriate to the foreseeable loads.

In classified areas concrete trenches shall be entirely filled with sieved and compacted sand. Cable supports shall allow easy sand removal (minimum distance between two layers: 0.20 m). The last layer is at 0.3 m from the cover.



Low points shall be avoided. Drains may be provided at the bottom of the concrete trenches, if necessary.

The trenches shall not be refilled until all cable tests have been completed and COMPANY approval.

4.2.6 Cable ladders or trays

Cable ladders and trays shall comply with the specification **GS ELE 311**.

A minimum of 20% spare capacity in each cable ladder/tray shall be provided for future extension.

Cable ladder/tray shall be bolted or clamped to support. Welding of rack/tray to structural steel will not be permitted.

Cable trays shall have mechanical protection, if they are situated between grade and 2 m above grade.

Protective covers shall be installed too, in any area where mechanical or chemical risks or heat (external source, sun rays, etc.) may be expected

High voltage cable trays shall be covered except inside sub-stations. Warning notices shall be applied on the edge or on the cover every 5 m and at each change of directions.

The ends of cable trays shall be finished in such a way as to avoid damage to the cable sheaths.

Joints in rack and tray shall be electrically bonded using the SUPPLIER's straps.

Cable tray having parallel routing shall be bonded together and linked to the structure every 25 m.

To avoid adverse chemical reaction, insulation pads shall be installed wherever dissimilar metals come into contact.

4.3 Cable installation

4.3.1 General

For cable installation, the CONTRACTOR shall comply with the cable MANUFACTURER's instruction (minimum bending radius, maximum safe pulling tensions, etc.).

Bending radius shall not be less than that recommended by the cable VENDOR but the minimum bending radius shall be:

- 13 times the overall diameter for HV cables
- 8 times the overall diameter for armoured LV cables
- 6 times the overall diameter for non armoured LV cables.

In general, cables shall not be installed (i.e. laid or pulled) when the ambient temperature is below 0°C.

Cables shall be neither pulled over edges or other hard and pointed obstacles, which could damage the cables, nor bent too sharply. All possible precautions shall be used to prevent kinking of the cable. Care has to be taken that cables are not subject to heat and strain or pressure.

Where necessary, temporary protective fire resistant blankets shall be laid over them if the possibility of damage from surrounding welding activity exists.

Single core cables supplying three phase loads shall be fixed in trefoil formation. Phase transposition is generally not required. Fixing must have been designed to withstand the prospective fault level as stated in the design documents.

Cables shall be bundled in groups of not more than twelve for control cables five for power cable up to 25 mm² and individually strapped for others.

Cables shall not be installed adjacent to any heated pipes or ducts. Where crossing above heated pipes or ducts is unavoidable, the cables must be kept at least 150 mm from the outer surface of insulation of such pipes or ducts. If needed a heat barrier should be installed to protect the cables from exposure to heat.

Cables passing through floors or located in other positions where they are liable to mechanical damage shall be protected to 150 mm above floor level (kick-plate).

Where cables are installed in cable ways of switchboards or panels, the cables shall be laid and terminated in such a way that later addition of cables or spare compartments can be performed without having to disconnect installed cables.

4.3.2 Installation on cable trays and ladders

Cables supported on cable trays or cable ladders shall be securely fixed as defined below:

- All LV and HV electrical and electronic cabling including fibre optic cabling, if any, shall be continuously and adequately supported and braced, additional protection against mechanical damage shall be provided where required
- One tie wrap/metre for horizontal runs and three wraps/metre for vertical runs shall secure power cable to the tray
- Tie wraps shall be stainless steel PVC or nylon coated and UV resistant
- Single core cables fixed in trefoil formation shall be secured by means of stainless steel banding on epoxy coated, galvanised, cast iron bases
- Special attention shall be paid so as to prevent any stress of the cable
- Minimum distance between a trefoil formation and other cables (trefoil or not) shall be twice the diameter of the single core cable.

Unless otherwise specified, cables shall be run on cable tray or ladder side by side and in layers. Power cables trays shall not have more than 2 layers. Control and instrument cables shall be installed in a neat and orderly manner and shall be adequately secured.

Where cable bundles for different applications are running parallel to each other, appropriate structural partitions shall be mounted or cables shall be installed on separate cable trays/ladders. In any case, the height of cables laid on a cable tray shall not exceed its height.

4.3.3 Cable transits

All cable transits through firewalls and from classified areas to unclassified areas shall be executed via Cable Transits.

Cable transits shall be provided with 20% spare entries minimum and shall be identified on each side of frame with laminated engraved plastic with black letters on a white background. Electrical and instrument cables shall be laid through separate cable transit frame.



Where single core cables pass through cable transits, each trefoil group shall be installed in the same transit frame, and non-ferrous stay plates shall be used.

Spare and unused cable transit frame opening shall be properly blinded or sealed.

4.4 Connections

Except for equipment in electrical power distribution area, cable entries shall be provided with cable glands.

4.4.1 Cable glands

Cable gland type and size shall be as specified on the drawings. Barrier glands shall only be used where required by [IEC 60079-10](#) and with the COMPANY approval.

Cable glands for armoured cables shall be complete with inner and outer seals and armour clamps.

For certified equipment, cable glands shall be of the same mode of protection as the device being cabled (i.e. EEx"d" glands for EEx"d" equipment).

If an adaptation is needed, only one reducer shall be allowed.

In case of GRP boxes connected by armoured cable, cable gland shall be Nickel plate brass type. If the cable is non-armoured, cable gland shall be polyamide type.

Only skilled personnel shall carry out the cable glanding. Special attention shall be paid to preparation of the ends. Cutting and stripping of the sheath shall be done carefully using proper tools without damaging the insulation.

When required, heat shrinkable sleeves shall be used to prevent the ingress of moisture into the cable termination and cable end. In this case the CONTRACTOR shall request COMPANY approval prior to proceed with the shrinking of the sleeves.

Cables shall be firmly secured to prevent stress at the termination, by means of a tie-wrap, at a distance of 100 mm from the cable gland to the offset strip or by other means, to the COMPANY approval.

Single core cable shall have an equipment entry via non magnetic gland plate and shall have an installation and clamping done in such a way to withstand the maximum short-circuit conditions that can occur.

All cable ends, which are not terminated immediately after cutting, shall be sealed effectively to prevent ingress of moisture and shall be protected from damage until termination is complete.

Outdoor cable entries shall preferably be either from the bottom or from the side, with the COMPANY approval.

4.4.2 Cable terminations

All cable conductors shall be provided with cable crimps of the compression type and shall be of the correct size and approved type for the conductor concerned. Non insulated wire sleeves to be used.

All HV terminations shall be carried out using appropriate termination kits (e.g. Elastimold) or sleeves as shown in the detail drawings.

All spare cable cores shall be individually terminated at the spare terminals.

All cores shall have an elastic shrink sleeve over the cable core.



It is the responsibility of the CONTRACTOR to define each individual cable type and length. An adequate percentage shall be allowed for slack, jointing, wastage, etc.

Application of grease if the connections are exposed to humidity shall be done; COMPANY shall approve quality of grease.

Checking of cleanliness and good contacts of conductive joint parts shall be performed.

Aluminium-copper connections shall be done with bimetallic lugs.

Cable armour shall be earthed at both ends.

Cable screens shall be earthed at panel side only.

4.5 Cable identification

All cables shall be identified at each termination and each side of any obstacle (e.g. cable transit, ducting extremities, etc.) if any, by their respective numbers, as indicated on the cable schedule.

Cable core ferrules shall be fitted at every termination. These ferrules shall be of engraved plastic slip on, interlocked and self grip type.

In trenches or in back filled concrete trench, cables shall be identified at each end and every 10 meters by stainless steel or plastic labels attached by ties. In other cases cables shall be identified at each end, at every direction change and at every 50 meters by stainless steel or plastic labels attached by ties.

The method of cable marking shall be submitted to COMPANY for approval before to be used.

5. Equipment identification

The CONTRACTOR shall install an engraved permanent identification plate for each electrical item. Each plate shall indicate the item tag number and shall be securely and permanently attached to it with rivets.

Rivets and plate shall be made of a material compatible with their environmental conditions (e.g. stainless steel 316L for offshore applications).

Tagging shall be done in such a way that equipment certification is not affected. The CONTRACTOR shall propose alternative if fastening by rivets shall affect certification.

All special warning notices and precautions, instructions or maintenance instructions shall be shown on a separate plate attached directly to the equipment where practical.

6. Painting

Any painting work shall be in accordance with the COMPANY General Specification **GS COR 350**.

7. Mark-up drawings

The CONTRACTOR shall provide to the COMPANY a full set of "Mark-up" drawings showing all the modifications brought during construction phase.



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The “Mark-up” drawings shall be prepared progressively, and shall be available to the COMPANY at all time for inspection.

These “Mark-up” drawings shall be used for updating of the as built drawings.